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WINNIPEG, MANITOBA

"THE TECHNOLOGY ENGINE IN COMMUNITY ECONOMIC DEVELOPMENT"

PROCEEDINGS FROM THE MANITOBA WORKSHOP

1989 National Technology Policy Roundtable

(August 29, 1989)

A Cooperative Project of:

* The Science Council of Canada
* The Canadian Advanced Technology Association (CATA)
* The Canadian Chamber of Commerce

Organized by:

* Winnipeg Business Development Corporation
* Manitoba Industry, Trade and Tourism

OCTOBER 1989

90-02286/

"THE TECHNOLOGY ENGINE IN COMMUNITY ECONOMIC DEVELOPMENT"

Proceedings From The Manitoba Workshop

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OCTOBER 1989

MESSAGE FROM THE CHAIRMAN

On behalf of the Steering Committee and the organizations who assisted in arranging the Manitoba Workshop held on August 29, 1989, I take pleasure in presenting the Proceedings of the Manitoba Roundtable discussions.

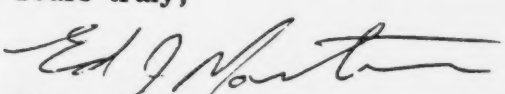
The objective of the event was to create a broad dialogue amongst organizations concerned with the development and use of science and technology in Manitoba. Also, to provide input to the National Roundtable, organized by the Science Council of Canada, the Canadian Advanced Technology Association and the Canadian Chamber of Commerce, as part of a national dialogue through similar workshops held in communities across Canada.

Each panel was to assess the Manitoba community's "Technology Engine" and to map out future directions. By "Technology Engine" we mean the complex of institutions, skills, networks, resources and attitudes necessary to foster technological dynamism. The participants were asked to review approaches that would best foster the emergence of small technology intensive firms; What can our business community do to help technology firms grow; What arrangements can help local firms have access to innovations; What sort of infrastructure and leadership are required; and to identify the champions at the community level.

The number and quality of the attendees exceeded the expectations of the organizers, thereby making this event a complete success. However, the real success of the workshop will be determined when a vision and a plan for action to address our science and technology problems, prospects and strategy for Manitoba is developed and implemented.

At the conclusion of the day, I indicated that the Steering Committee will act as an interim group to bring forward the recommendations to key government and business leaders. Following these discussions we will inform the Manitoba community about our progress.

Yours truly,



Ed J. Martens
Chairman

RECOMMENDATIONS FROM THE HALIFAX DECLARATION

1) A PUBLIC COMMITMENT TO REACH 2.5% OF NATIONAL SPENDING OF OUR GNP ON SCIENCE AND TECHNOLOGY BY THE BEGINNING OF THE 21ST CENTURY;

2) ADOPTION OF A NATIONAL DATA GATHERING SYSTEM TO HELP TRANSFORM THE SCIENCE CULTURE OF OUR SOCIETY AND A NATIONAL AWARENESS CAMPAIGN INVOLVING CANADA'S SCIENCE ADVISORY COUNCILS:

3) NEW AND CHALLENGING REFORMS TO ENHANCE EXCELLENCE IN EDUCATION AT ALL LEVELS AND NEW INITIATIVES IN METHODS OF INSTITUTIONAL FUNDING, MARKET ADJUSTMENT, AND LABOUR PORTABILITY, AS INCREASED NEW EFFORTS IN LITERACY SKILLS;

4) INCREASED EFFECTIVENESS IN INDUSTRY, OUR TRADITIONAL RESOURCES, AND OUR MANUFACTURING SECTOR WITH REGARD TO THEIR CAPABILITY IN SCIENCE REQUIRED IN TODAY'S GLOBAL MARKETPLACE IN ORDER TO SUCCEED AND WIN; AND

5) INNOVATIVE WAYS TO ASSIST AND ENCOURAGE CANADIAN TECHNOLOGY COMPANIES.

OVERVIEW

On August 29, 1989, over 100 community leaders gathered in Winnipeg to conduct the Manitoba Workshop as part of the National Technology Policy Roundtable, sponsored by the Winnipeg Business Development Corporation and the Department of Industry, Trade and Tourism. The objective of the Roundtable was: to assess Manitoba's Technology Engine in Community Economic Development; to review the issues and opportunities regarding Manitoba's science and technology; and to formulate a statement of action.

Following the format and guidelines provided by the National Roundtable, the panelists were organized into five groups to:

- Identify the mechanisms to develop growth poles to create technological enterprise;
- Review the necessary infrastructure for the development and diffusion of technology to broaden and deepen Manitoba's technological base;
- Determine the roles and responsibilities for gearing up the technology engine in Manitoba;
- Determine the requirements for economic development planning for science and technology; and
- Review the requirements to build a technology network.

Excerpts From Speakers Views

The Hon. James A. Ernst, Minister of Manitoba Industry Trade and Tourism, provided the Welcome Address for the Workshop. Mr. Ernst indicated that, given the caliber of representation gathered at the Workshop, he could see a great potential for fulfilling a prime objective for Manitoba; The consolidation of business, industrial, academic and government sectors into a cohesive, coordinated, constructive and cooperative entity, to stimulate meaningful research and development work.

He stressed the commitment of the Premier of Manitoba towards following the core recommendations of the Halifax Declaration, endorsed by all Premiers in August, to reverse the slipping trend Canada is facing in the Technology Race despite a rather strong economy. As such the Minister assured that the Government is committed to provide the private sector with the environment that will stimulate research and development. He called upon the business, industrial and educational leaders - **"to provide the Government with the guidance and advice to make the decisions and establish programs and initiatives that will best serve their needs and requirements to meet common objectives".**

In closing, Mr. Ernst asked the Chairman to meet in order to review the outcome of the Workshop, the ideas and directions outlined, so as to set into motion a plan of action.

Dr. Charles Davis provided a view from the Science Council of Canada. He stated that there are two ironies in Canadian S&T policy.

The first is that although Canada seems to have more science and technology policy per square foot than other countries, we still lack a sense of direction; There seems to be an inverse relationship between the amount of talking that goes on about innovation in Canada and the degree of agreement about what the problem is, what its causes are, what its consequences could be, and what some possible solutions might be.

The second irony is that we've had six or seven years of unparalleled prosperity in Canada: one of the fastest economic growth rates of all OECD countries. Times have been so good that some people deny that there is a problem at all. Yet our performance in science and technology has been pathetic. Virtually every other industrialized country, however, has increased the percentage of gross domestic product invested in R&D. Investing in R&D is now the price of staying in business in global markets. Other countries seem to be learning this lesson much faster than Canada.

The Canadian economy is capable of absorbing high technology. We have a huge appetite for sophisticated manufactured goods. Our appetite is so huge that we've developed a gigantic deficit in our balance of trade in these products. The deficit has worsened considerably since 1978 - from $3 billion to $7 billion. Canada is alone among Western industrial countries in running a chronic negative balance of trade in highly R&D intensive industries.

Basically, we're exchanging our rocks, trees, fish, energy and agricultural produce for manufactured products. We trade these things for simple products from the newly industrializing countries, and for complicated products from the world's industrial leaders. Now we're being encouraged to sell our water, too. That's the kind of role we're being asked to play.

Science and technology have become the basis for international competitiveness. The emergence of science and technology as drivers of international change has taken almost everyone by surprise. Except for a relatively marginal current of thought, our economists were not prepared to explain why science and technology would reshuffle the deck of the entire international trading system.

The fifth Kondratiev cycle in the internationally accepted long wave theory is just now beginning. The technological systems that will drive industrial expansion in the next half century are not foreseeable, but will probably involve a combination of information technology, microelectronics, advanced materials, and biotechnology.

The wisdom and metaphors from previous technological ages do not particularly help us think about what the technological advantages of a community such as Winnipeg might be. For instance, in science and technology policy, we always talk about "critical mass", a metaphor from nuclear physics. Unless a community has a certain threshold number of scientists or technology-intensive firms, it is said, the community cannot be vigorous.

I have seen Canadian communities that really don't care. How much don't they care? Their leaders cannot be bothered to participate in a meeting such as this one; or, they have no leaders at all. These communities have no choice: they have to take what comes to them. - **Clearly, Winnipeg does have choices. By looking around you, you can see what potential Winnipeg has. I hope that this meeting is just the first step in an ongoing process to provide Winnipeg the leadership it needs to effectively make use of its technology engine.**

Mr. Ralph Bullock (Vice President of Engineering, Bristol Aerospace Ltd.) provided a Manitoba perspective and impressed upon the need to increase our competitiveness for world class performance.

We have come to take for granted our high standard of living, demanding increased expenditures in social services beyond our capabilities to finance them through increased productivity - this is central to the cause to increased government deficits. Canada has a deficit of $8 billion in high technology products and the deficit in manufacturing has reached $27 billion. At this pace, the result must be collapse if we do not change.

The change must come from improvements in manufacturing; by improving the management of resources and by the application of advanced science and technology. Consumers have grown to expect high quality products at world wide competitive prices. Unless we change our management methods and increase innovation we will be increasingly dependent on products manufactured abroad.

Economically successful countries produce high quality products. In terms of quality and performance, most Canadian firms are only at the first level of seven identified by a Japanese consultant. The application of advanced engineering, production management and quality control to achieve "Total Quality" the first time, every time, is required for Canadian products to achieve "World Class Performance".

Manitoba has enough industry to form a critical mass for the production of manufactured goods to satisfy world demand. We need to improve the image of ourselves and build on our strengths (such as our universities and research centers) and minimize the perception of our weaknesses (such as our climate). To do it we need to increase cooperation amongst groups trying to advance their community interests.

The support requirements at the national, provincial and community levels need to be reviewed and refocused to set in motion the leadership and resources which will help us maintain, if not increase, our high quality of life.

Plenary Session

The conclusions arrived at the Plenary Session, under the chairmanship of Dr. Arnold Naimark (President, University of Manitoba), indicated broad consensus that - **"follow-up to the conference is essential to keep the spirit and commitment of the community to cooperative action alive".**

Furthermore, it was recommended that the organizers of the Workshop should formulate an action plan to present to government, business and educational communities, which reflects the outcome of the Workshop so that new initiatives can be identified and supported through a high level commitment. The plan should be centered around the following four major areas for action:

- The establishment of a Premier's Council;
- Formalize mechanisms to coordinate economic development planning;
- Develop an inventory of strengths and resources; and
- Promote interaction between government enterprises and the business and educational communities.

A1 - Establishment of a Premier's Council

The vast majority of panelists concurred with creating an "Enabling Environment" as the critical first step towards stimulating the economic development of the Province. There was consensus in the need to establish a Premier's Council to be comprised of leaders from the business community and educational institutions.

The main objective of the Council would be to formulate a vision for Manitoba and a plan of action, to identify opportunities in key niches of strategic importance and to coordinate actions throughout the community. Also, to propose solutions on key issues related to enabling factors needed by private enterprises to stimulate Manitoba's development and application of science and technology.

Such issues would include those already known to government (such as taxation policy to stimulate high technology investments, financing, industry-university relations, developing local markets for Manitoba's own products, advanced education, etc.), and others such as advanced R&D and most importantly, a continuing dialogue with federal and municipal governments to facilitate interaction.

The role of the Council and issues to be addressed are outlined in the recommendations from panels 1,2,3,4 and 5, included in the Workshop Proceedings.

A2 - Mechanisms to Coordinate Economic Development Planning

Panel 4 was specifically concerned with planning for science and technology. The panelists concluded that a plan be formulated to determine what the right enabling environment should be, in order to achieve economic development planning amongst business, academia and government leaders.

It was recommended that a consortium of private sector organizations be established, with the volunteer participation of "community champions" to lead the action. The plan should include a study to define the parameters needed to establish a right environment, the process to achieve its implementation throughout the community and identify who should assume responsibility for implementation.

A3 - Inventory of Manitoba's S&T Strengths and Resources

Understanding Manitoba's capabilities was outlined by panels 1,4 & 5 as key to promoting Manitoba's S&T strengths within the private, education and public sectors. As such, it was recommended to establish and maintain an inventory of strengths and resources available within the private sector, university and governments. The objective would be to establish complementary mechanisms to identify voids, problems and opportunities in economic development.

As an example, a comprehensive inventory of S&T capabilities within the University of Manitoba has been developed by the Institute of Technological Development and may be expanded to include those of the private and public sectors. Properly maintained, such an inventory can also be used as a baseline for future comparisons.

Panel 5 also recommended the development of a province-wide listing of organizations and network contacts to determine the "community of interest" between organizations.

A4 - Role of Government Enterprises in S&T Economic Development

Establishing the "right enabling environment" would include the exploitation of opportunities for interaction between government enterprises and the business and educational communities, as key in the promotion of technology development and transfer.

Manitoba has several examples of successful collaboration which have resulted in developing and marketing Manitoba's expertise worldwide. The development of a process for proactive identification and pursuit of such opportunities, can expand the role government enterprises have as potential major participants in economic development related to science and technology.

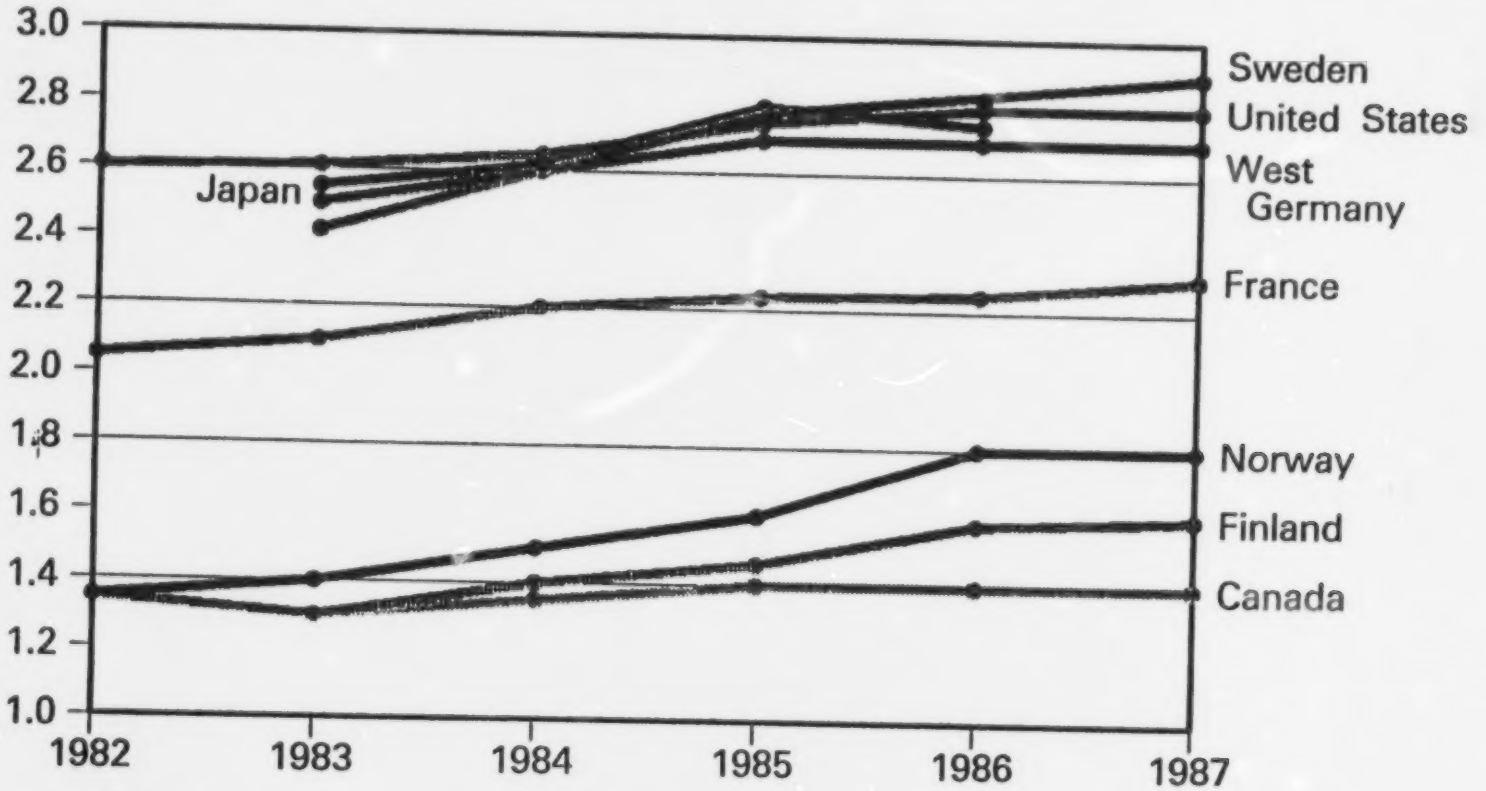
Workshop Proceedings

The workshop generated significant thoughts and ideas which could not be debated fully, in view of the available time. In order to preserve the essence of the panelist contributions, Workshop Proceedings were assembled including, where available, the individual opinions and ideas expressed during the panel discussions. A separate document was prepared to include the panelist guidelines and the list of participants with a profile of their organizations, available upon request from:

The Winnipeg Business Development Corporation.
509 - 167 Lombard Avenue
Winnipeg, Manitoba
R3B 0V3

GERD as Percentage of GDP, Selected Countries

Science Council of Canada / Conseil des sciences du Canada



Source: Data in OECD table.

FIGURE 1

I VIEWS FROM THE SCIENCE COUNCIL

Address by: **Dr. C. H. Davis**
Science Advisor
Science Council of Canada

On behalf of the Science Council of Canada, the Canadian Advanced Technology Association, and the Canadian Chamber of Commerce, welcome to the Manitoba Workshop for the 1989 National Technology Policy Roundtable.

It is truly impressive to see such a turnout for an event about technology and innovation. It shows that community leaders are taking this subject seriously. Some Canadian communities do not have strong leadership in science and technology. I believe that however magnificent their infrastructure may be, communities without leadership in S&T face a significant disadvantage.

My message today is that there is a great deal that communities can and must do to gear up their technology engine. And community level leadership is a crucial factor in this process.

1. Technology And The National Challenge

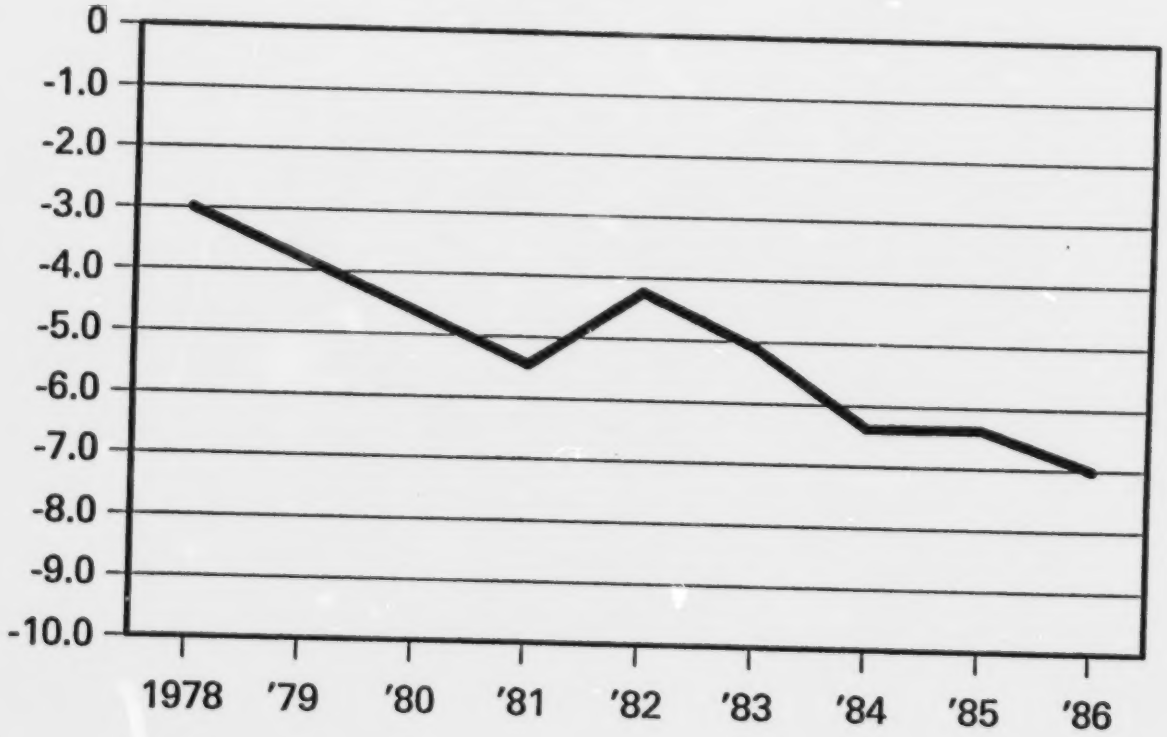
As we near the end of the 20th century, we look around and see that technological change is becoming pervasive. The impacts of new technology are being felt in many more places, in many more ways, than ever before in our lifetime. What is technology; why does it change; what does it mean to us; and what should we be doing about it? These are, in my view, among the most interesting questions that can be asked in our times. They are also among the most important and difficult questions that we can ask.

Whatever our answer to these questions, I am sure we all agree that technology and technological change are creating some fundamental challenges for Canada. These challenges have to do with the ways that we earn our living in this country. We are accustomed to relying on our rich natural resources to generate wealth. Now we must begin to comprehend that these kinds of resources will not guarantee us prosperity in the emerging international economy. There are good reasons to believe that Canada, if we continue on our current course, will not be amongst the most dynamic, creative, prosperous countries on earth.

Science and technology are the keys to the emerging knowledge economy. Increasingly, scientific and technological capability provide the basis for national competitiveness. Our future is directly related to our ability to create, select, and apply science and technology to create goods and services that are competitive in international markets.

Canada's High-Tech Trade Deficit ($ 000 000 000s)

Science Council of Canada / Conseil des sciences du Canada



Source: Statistics Canada.

FIGURE 2

I'm sure that you are aware of this, because science and technology have been high on the agenda for the last few years. You may have come to the same conclusions I have about science and technology policy in Canada. It seems to me that there are two ironies in Canadian S&T policy today.

The first is that although Canada seems to have more science and technology policy per square foot than other countries, we still lack a sense of direction. There seems to be an inverse relationship between the amount of talking that goes on about innovation in Canada and the degree of agreement about what the problem is, what its causes are, what its consequences could be, and what some possible solutions might be.

This tells me that there are no easy political solutions to the problems raised by innovation in Canada. No government, no industry, no university, no community can by itself simply step forward and solve these problems. Many small adjustments can add up to a significant improvement, but clearly we are going to have to invent solutions on a national scale with an eye to the long term.

The second irony is that we've had six or seven years of unparalleled prosperity in Canada: one of the fastest economic growth rates of all OECD countries. Times have been so good that some people deny that there is a problem at all. Yet our performance in science and technology has been pathetic.

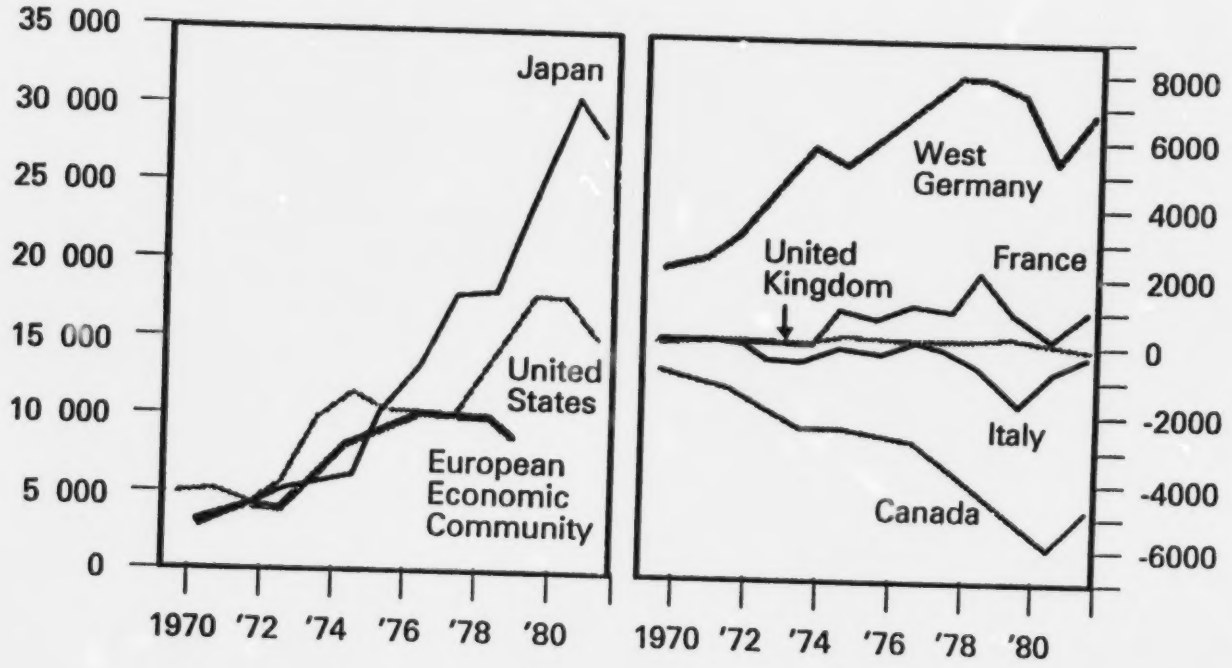
Figure 1 shows the relation between our gross expenditures on research and development (GERD) and our gross domestic product (GDP). The GERD/GDP ratio is one conventional indicator for gauging the knowledge-intensity of national economies. We have only maintained our R&D capability and have not tried to expand it significantly. We have not been reinvesting in our innovation system. Virtually every other industrialized country, however, has increased the percentage of gross domestic product invested in R&D.

Investing in R&D is now the price of staying in business in global markets. Other countries seem to be learning this lesson much faster than Canada. Do we have a peculiar learning disability? Our economy is capable of absorbing extremely sophisticated high technology. We have a huge appetite for R&D intensive manufactured goods. Our appetite is so huge that we've developed a gigantic deficit in our balance of trade in these products. As Figure 2 shows, the deficit has increased throughout the 1980's. It has worsened considerably since 1986.

Basically, we're exchanging our rocks, trees, fish, energy and agricultural produce for manufactured products. We trade these things for simple products from the newly industrializing countries, and for complicated products from the world's industrial leaders. Now we're being encouraged to sell our water, too. That's the kind of role we're being asked to play.

Trade Balance of Highly R&D-Intensive Industries by Country ($ 000 000s)

Science Council of Canada / Conseil des sciences du Canada



Source: Ministry of State for Science and Technology, *Science, Technology and Economic Development: A Working Paper* (Ottawa, 1985), 38.

FIGURE 3

People correctly say that Canada can't invent everything. We only produce 2% of the world's technology, so it makes sense for us to import most of what we need. But this doesn't dispense us from having to innovate if we want to remain an industrialized country. Increasingly, we won't even be able to absorb advanced technology unless our industries maintain vigorous R&D efforts.

Most major industrialized countries are at least capable of trading knowledge-intensive products for other knowledge-intensive products. As Figure 3 shows, Canada is alone among Western industrial countries in running a chronic negative balance of trade in highly R&D intensive industries.

Most of our competitors try not to let these things evolve by chance. They are determined to remain competitive in knowledge-intensive manufactured goods and services. Of course, most of them have no choice, because they don't have natural resources. They have to be aggressive, and they are.

2. Why Are Science And Technology The Basis For International Competitiveness?

Science and technology have become the basis for international competitiveness. But why should this be so? Why should the future be very different from the past, as far as science and technology are concerned? The emergence of science and technology as drivers of international change has taken almost everyone by surprise. Except for a relatively marginal current of thought, our economists were not prepared to explain why science and technology would reshuffle the deck of the entire international trading system.

In order to reduce reality to manageable proportions, mainstream economics has had to make two assumptions. One is that economic systems tend toward equilibrium. This may be so in the very long term, but it is clearly an assumption that underestimates the destabilizing effects of innovation. When are we likely to see a technologically dynamic economy in equilibrium? The second assumption is that innovation comes from outside the economic system, that it is a residual factor. Yet clearly some economies have greater ability than others to invent, to adapt, to organize factors of production in new ways, and even to create new factors of production through research.

One interesting attempt to explain why technological innovations are swarming around us at this particular historical moment is known as "long wave theory". Invented by the Russian economist Kondratiev and subsequently developed by others, this theory poses "natural" 50-to-60 year cycles to industrial capitalism. These are know as "K cycles", after the inventor. Each K-cycle is associated with and propelled by a characteristic cluster of technologies.

The first cycle began in the 1760's and was based on the cluster of technologies that drove the Industrial Revolution: steam power and iron. The second cycle began in the 1820's and was driven by technological systems associated with railroads and steel.

The third K-cycle (beginning in the 1880's) was based on electricity, automobiles, and chemicals. Electricity and chemicals were the first "science-based" technologies which have now become so pervasive. It is not surprising that the third K-cycle also saw the invention of research universities, industrial labs, and science policy. The fourth K-cycle began in the 1930's. Industrial expansion was based on electronics and aerospace technologies.

The fifth K-cycle is just now beginning. The technological systems that will drive industrial expansion in the next half century are not foreseeable, but will probably involve some combination of microelectronics, information technology, advanced materials, and biotechnology.

Historians and economists are still debating the theory of long waves. For our purposes it is enough to emphasize that history pretty much confirms the existence of four previous bursts of technological innovation, and that we are now probably seeing the beginning of a fifth burst. Like all the others, it will require many adjustments. There are three conclusions that I draw from these observations.

The first is that high-performance innovation systems are the key to economic prosperity. It is unlikely that Canada can remain an industrialized country unless we take great care to nurture and expand the institutions that make a knowledge-based economy work: our labs, our schools, our managers and bankers who understand technology, and so forth.

The second is that our innovation system is a national resource, but it is evolving in ways that we are only beginning to understand. We need to understand it much better. The Canadian science policy impasse is partly due to the fact that we have never taken innovation seriously enough to require much of an understanding of it.

The third conclusion is that the imperative to innovate puts tremendous pressures on our social and political institutions, which were not designed to facilitate (or even accommodate) rapid changes in the technology base. None of the conventional behavioral repertoires of our traditional economic, S&T or political organizations is particularly well-suited to facilitating the kind of social innovation that must accompany technological innovation. The old boy peer review system, the market, the public or private bureaucracy, and the political party were all designed for other purposes than to facilitate the flexible adjustment of innovation systems in the common interest. None does this well.

3. Looking At Ourselves

The best example can be taken from our own political system. It ensures political representation based on geography and regular elections. It may have warts, but it reflects values that we cherish, and it is performing splendidly - exactly as it is supposed to. But it was designed in the 19th century, when railroads were high technology. It does not seem to be a decision-making system that can efficiently address some critical problems of a knowledge-based economy. Our political system has great difficulty generating a national strategy for higher education, for example.

As we begin to take innovation seriously, we naturally look at others and ask why they are able to do so well. We also look at ourselves, and try to spot why we are less successful.

It is interesting that the science policy debate has led to questions about culture. For instance, we frequently hear that Canada lacks a scientific culture. Culture is something intangible and qualitative. It reflects beliefs, attitudes, and values, and the institutions that shelter and perpetuate them. By focusing on culture, we indicate our belief that social values and institutional characteristics are the best way to explain any society's industrial performance.

Maybe instead of exporting our anthropologists to the third world, we should ask them to help us understand ourselves. Anthropologists are good at identifying and explaining the fundamental distinctions around which culture and supporting institutions are organized. Often, these distinctions are dichotomies. For instance, many traditional cultures make very firm distinctions between the sacred and the profane, or between the insider and the outsider. Changes that affect these distinctions can disorient a culture.

An equivalent in our own culture might be the distinction between public and private. Think of how many institutions, transactions, rights, and obligations are built on this distinction. Interestingly, rapid changes in science and technology have blurred the distinction between public and private.

Our institutions are adjusting as best they can. For example, when we ask a private firm to undertake basic research, we are asking it to produce a public good, a good that can be appropriated at no cost by someone else. When we are asking a public laboratory or a university to produce technology, we are asking them to produce a private good, a good that someone else can appropriate and monopolize. In each case, the institution's administration, management, internal reward system, and mechanisms for interacting with the environment have to be substantially adjusted.

Technology Engine Links to the Community

Science Council of Canada / Conseil des sciences du Canada

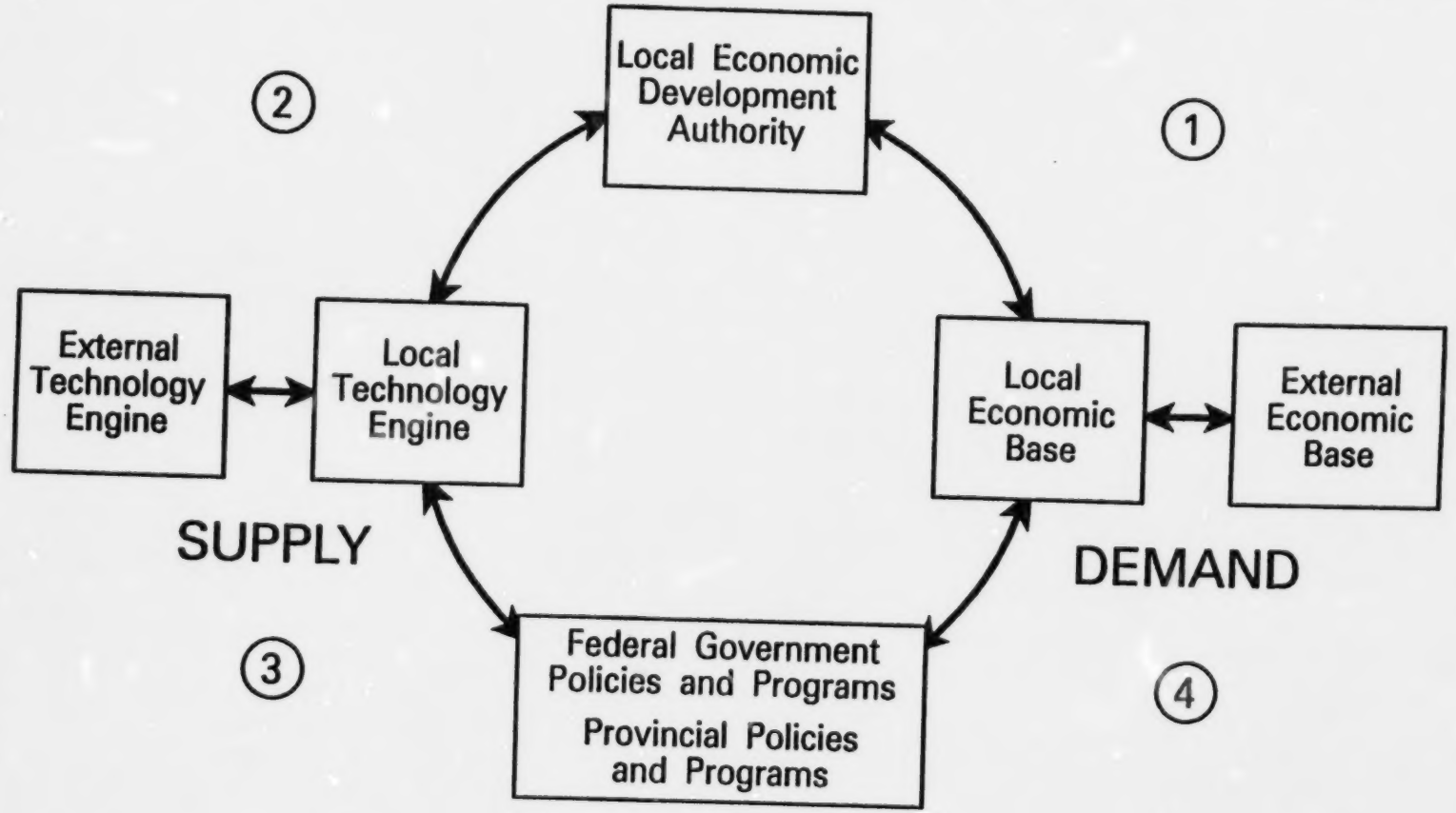


FIGURE 4

Another important distinction in our culture is that between competition and cooperation. This distinction also is being reshaped, whether we like it or not, by science and technology.

We like to think of competition and cooperation as polar opposites. In this dichotomy, the pole "competition" is culturally visible, and the pole "cooperation" is submerged, out of sight, Individuals and teams compete. Entrepreneurs are the paradigm of competitive individuals. They are so important that we have special research programs in universities to study them.

Many of us would have a hard time identifying cases of cooperation in our culture. We know that cooperation occurs frequently, but no significant examples seem to leap out. We don't seem to consider cooperation to be all that important.

This is ironic, given the eternal call in Canada for consensus. I meet increasing numbers of people in Canada who believe that our most serious weakness is our inability to devise cooperative institutional arrangements at all levels of society. We persist in treating technological change as a zero-sum game. This is a game in which for every winner, there's a loser. Yet any marriage counselor will tell you that to sustain a long-term relationship, there must be no losers.

4. Social Complexity And Modern Innovation Systems

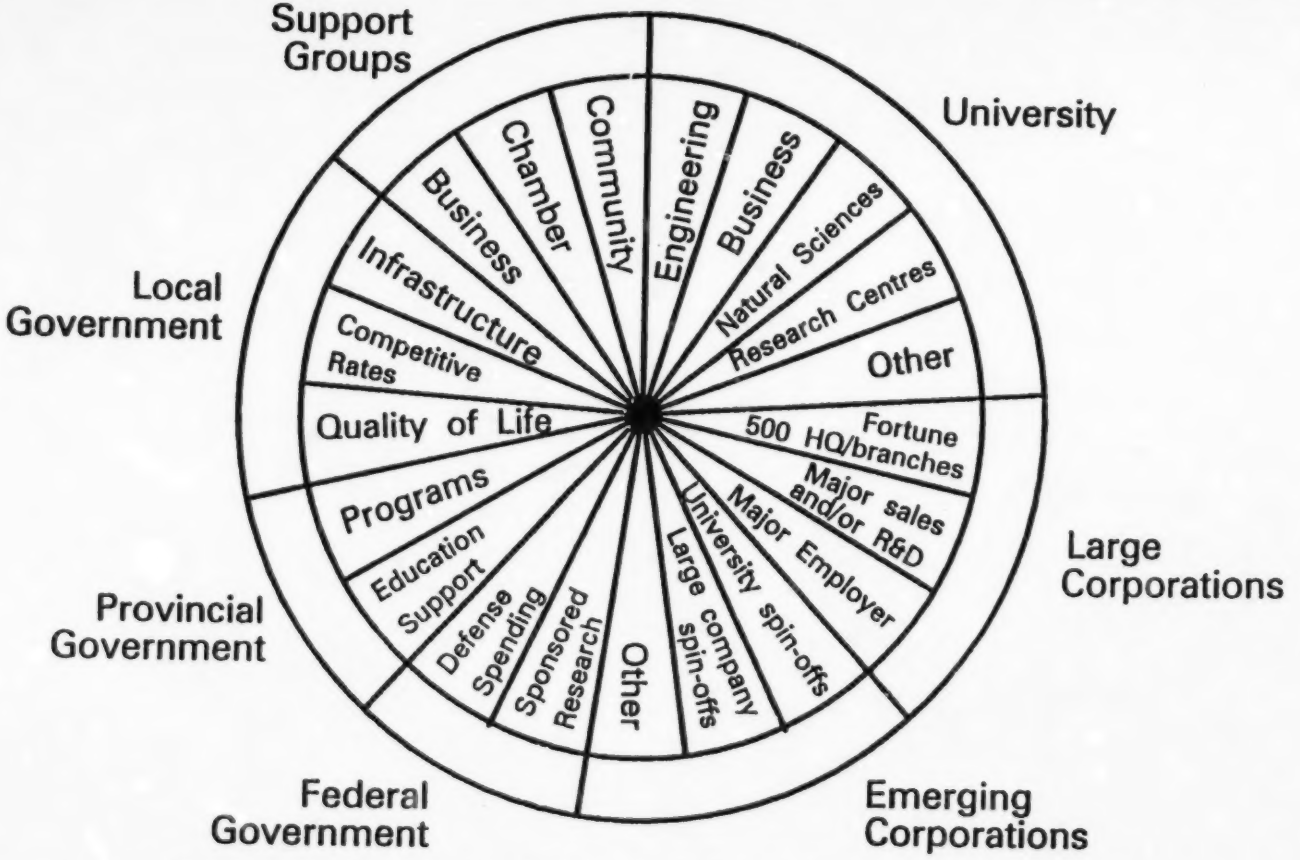
I mentioned earlier that the technological paradigm of the next half century is beginning to emerge now. Evidence is accumulating that whatever the particular technologies may be that drive industrial expansion over the next fifty years, they will be sustained within very complex innovation systems. When I describe just one aspect of such an innovation system, you will see why the ability to cooperate might be a cultural value that is well suited to new technologies and innovation.

Figure 4 depicts what we are calling the local technology engine. It is a complex of players that must have good links within and outside the community. Who should be looking after these links? Traditional industrial development initiatives usually involve the local economic development authority acting upon the local economic base (see Quadrant 1). These initiatives typically concern zoning, maintaining the physical infrastructure, and attracting industry from elsewhere.

Quadrant 4 of Figure 4 represents a policy zone in which senior levels of government provide incentives for local industrial development. Some of these can affect the local economic base's demand for technology, as when, for instance, a provincial government requires innovative products or services that are locally procured.

The Technopolis Wheel

Science Council of Canada / Conseil des sciences du Canada



Source: *Creating the Technopolis* (Cambridge, Mass: Ballinger Publishing Company, 1988), 146.

FIGURE 5

Quadrant 3 of Figure 4 shows the traditional domain of Canadian science and technology policy; senior levels of government acting directly or indirectly to increase the supply of technology by constructing the infrastructure of local technology engines. In Canada we have had relatively good success in this policy domain.

Quadrant 2 shows a virtually unorganized area of technology policy and strategy in Canada; the area of interaction between the local economic development authority (or authorities) and the local technology engine. Most of the time, local authorities either ignore technology or treat it like any other industry. The main thrust of the 1989 National Technology Policy Roundtable is to raise awareness about the unexploited potential in this quadrant and help identify options for locally-generated technology policies and strategies.

Let's take a closer look at what's inside the local technology engine. Figure 5 shows a stylized representation of the "players" in the typical local technology engine. These range from local government to senior government, firms of different sizes and kinds (high tech, low tech and no tech), business associations, and universities. I would add banks, other financial institutions, and teaching and training establishments of all kinds to this picture.

These are the "players" in the technology engine, the local innovation system. Every major metropolitan area in Canada has a set of institutions like these. They are the very institutions that most of you make major decisions for, every day.

I'd like to draw together several strands of thought that I've expressed throughout this talk. One strand has to do with how do we make ongoing adjustments in our technology engines are the technologies driving the Fifth K-cycle transform the economic system. Another has to do with cooperation, and a third has to do with our cultural values. Specifically, I would like you to consider these themes in the framework of managing, tuning, nurturing and using the Winnipeg technology engine.

If you read the scholarly and popular literature on regions that are technologically creative, you will find constant references to Silicon Valley, Route 128, and the Research Triangle Park. When we think of creative local innovation systems, we think of these three cases. We seem to be transfixed by them.

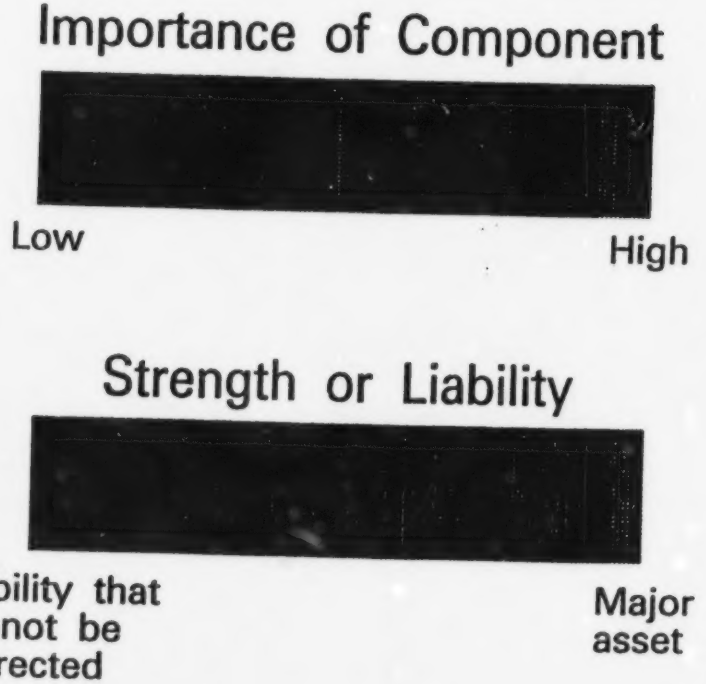
Many communities emulate Silicon Valley. Study of Silicon Valley and other famous technology agglomerations has generated a list of necessary attributes of a technology agglomeration. Figure 6 is an example. You can compare what you have against the ideal profile of a technologically dynamic community and make the necessary changes. Then you can hope to become like Silicon Valley.

Analysis of Urban Strengths and Liabilities

Science Council of Canada / Conseil des sciences du Canada

Component

1. Local labour market
2. Access to markets
3. Development facilities
4. Transportation
5. Education/training
6. Quality of life
7. Business climate
8. R&D facilities
9. Capital availability
10. Taxes/regulations



Source: Group on Urban Affairs, *Project Group on Urban Economic Development -- Final Report* (Paris: OECD, 1985).

FIGURE 6

Such lists as Figure 6 reflect an understanding of the necessary conditions for creating a technology dynamic region. But no one seems to know what the sufficient conditions might be. One intangible attribute is clearly the ability to flexibly adjust the local innovation system through collaborative action. European countries recognize this social skill and call it "collective entrepreneurship", to align forces and help the system work.

Figure 5 only hints at the social complexity of innovation systems. Innovation systems are composed of intricate social networks. One important characteristic of innovation systems is that the components have to be functionally interdependent. They have to "fit" with each other. No one has ever undertaken to design this functional interdependence - it is created and adjusted as we go along. As the number of players increases arithmetically, the number of possible linkages increased exponentially, so just coordinating things can be a challenge.

Making such a system work requires trust, flexibility, good will, vision, commitment, tolerance, experimentation, communication, and leadership. These are cultural skills that can be learned but not legislated and are precisely the kinds of skills necessary to make effective use of available policy instruments. As shown in Figure 7, most such instruments aim at making qualitative changes in the environment. They cannot succeed without local leadership. They may also require resources. Senior levels of government must be prepared to help support local initiatives.

The received wisdom and metaphors from previous technological ages do not particularly help us think about what the technological advantages of a community such as Winnipeg might be. For instance, in science and technology policy, we always talk about "critical mass", a metaphor from nuclear physics. Unless a community has a certain threshold number of scientists or technology-intensive firms, it is said, the community cannot be vigorous.

As Figure 8 shows, only a handful of Canadian communities account for about half of Canadian scientific, engineering and mathematics occupations. How big do you have to be to reach critical mass in technology? There are surely threshold effects, but at what level? Even the largest of these Canadian technology agglomerations are modest by North American standards.

In my opinion, it would be better to think about catalytic action and networks than critical mass. Isn't this a more useful way to think about what communities can do to gear up their technology engine? Size is not unimportant, but it is only the equivalent of hardware. Networks and concerted action are the equivalent of software. All things considered, it might be better to have a smaller technology engine and imagination, good networking, leadership and collective entrepreneurship, than to have a bigger technology engine in a community that just doesn't care.

Instruments Used by Communities to Promote Technological Development and Focus Efforts

Science Council of Canada / Conseil des sciences du Canada

- Technical and financial services
- Incubators
- Science/technology parks
- Technology transfer offices
- Education, including retraining
- University-industry linkages
- Information exchange & communication among institutions
- Increase technology appreciation by non-technical persons
- Recognition of excellence in technology
- S&T strategies
- Organizations to promote S&T in local development

FIGURE 7

Share and Intensity of Natural Science, Engineering and Mathematics Occupations by Metropolitan Area, 1986

Science Council of Canada / Conseil des sciences du Canada

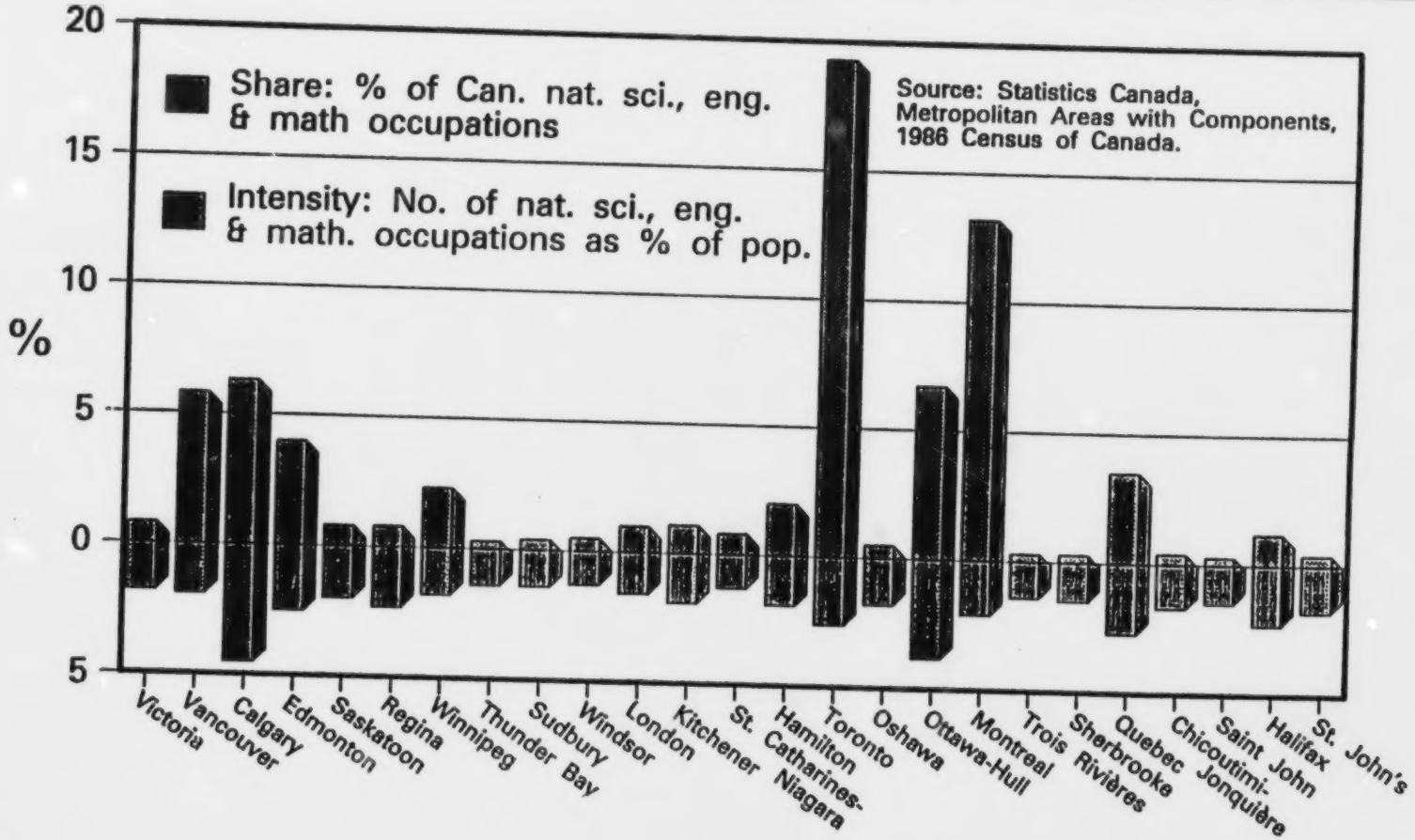


FIGURE 8

I have seen Canadian communities that really don't care. How much don't they care? Their leaders cannot be bothered to participate in a meeting such as this one; or, they have no leaders at all. These communities have no choice: they have to take what comes to them. But clearly, Winnipeg does have choices. By looking around you, you can see what potential Winnipeg has. I hope that this meeting is just the first step in an ongoing process to provide Winnipeg the leadership it needs to effectively make use of its technology engine.

Workshops of the sort of the Manitoba Technology Policy Roundtable are breaking new ground. They are creating a new kind of science and technology culture - one that enhances our ability to manage complex innovation systems.

I hope that this workshop contributes to developing a stronger local consensus on the role of technology in community economic development. I also hope that the workshop, together with the larger National Technology Policy Roundtable, will contribute to a better understanding of what needs to be done nationally to "gear up" the technology engine in your community.

With a turnout like the one today, there is no need to wish you success. I would rather congratulate you for what already is a successful event.

Thank you.

II MANITOBA PERSPECTIVE

Address by: **Mr. W. R. Bullock**
Vice-President, Engineering
Bristol Aerospace

My job is to convince you of the importance of this Workshop and the National effort it is associated with. My hope is that you will become so enthused (or perhaps frightened) that our Workshop will be a stirring success.

Let me lead you through the situation in which we find ourselves in Canada, and see if this provokes some thoughts as to how we, in the communities of Manitoba, can improve our performance in world market places.

1. The Need for World Class Performance

The international market place is tough. The pace of progress is accelerating - we must now move very fast just to keep up. But if we wish to maintain our standard of living we must succeed.

In referencing the Model for Society (Figure 1), there are problems in the wealth generation sector:

- Natural resources are plateauing

  : Food production larger than consumption;
  : Timber resources are becoming depleted;
  : Our mineral resources are dwindling; and
  : We have limited energy resources.

- The manufacturing sector is immature

  : Canada has a high technology products deficit of $8B;
  : The manufactured end items deficit has reached $27 B;
  : We are not keeping up, but losing ground; and
  : Europe 1992 will make it tougher to compete.

- Our expectations in quality of life are becoming unrealistic

  : The high standard of living has been sacrosanct to Canadians;
  : The voters will not tolerate any reductions;
  : The cost of our social services exceeds Canadian capability;
  : As such, the deficit rising.

- The result must be collapse if we do not change

- Change must come from improvements in manufacturing

MODEL OF SOCIETY

Wealth Generation

The things we sell as a nation to finance our Quality of Life.

Includes manufacturing, resources and some services.

Characterized by declining number of people.

Infra-Structure

The groups needed to make society function.

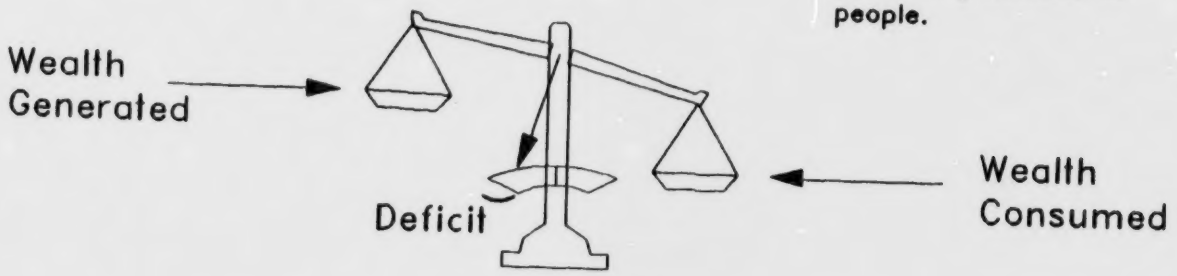
Includes banks, lawyers, etc.

Quality of Life

The things we enjoy in our leisure time, to simplify our jobs, etc.

Includes education, medical care, arts, literature, sports and most services.

Characterized by increasing number of people.



2. The Role of Science and Technology

- We need improved management in the use of resources through

  : Value management;
  : Simultaneous engineering; and
  : Application of Material-Resource-Planning, Just-In-Time inventory management, Total-Quality-Control and Total-Quality-Management.

- We need to apply advanced technology

  : In manufacturing - to reduce errors and labour content;
  : We need to apply Computer Assisted Manufacturing, Computer Integrated Manufacturing and Computer Assisted Engineering throughout the manufacturing process;
  : There is a need for continuous product improvements (Value Management); and
  : Introduce innovations for new products

- Total Quality Management

  : Japan leading in Total Quality Management;
  : They learned from the USA and now they are teaching the USA;
  : A Japanese consultant to Ford described seven levels of Quality Achievement that a Company might reach

Levels of Quality Achievement	
1	Inspect after manufacture
2	In-process inspection
3	Total Quality Control (all departments involved)
4	Involve all employees (through training and education)
5	Design optimization
6	Society cost optimization
7	Develop products to satisfy customer requirements

  : Many Canadian companies are at the first level and reaching for the second - a small number have reached the third level;
  : This is the one management concept that deals primarily with changes in peoples attitudes...the one that says "Do it right the first time, and every time"; and
  : If you look after Total Quality, cost and delivery will improve.

3. The Support Requirements

- At the National Level

  : Federal Government (through funding for facilities, contracts, improved taxation, policies to stimulate investment and R&D and procurement);
  : Research Centers; and
  : Support to Develop Strong National Associations;

- At the Provincial Level

  : Increase Resources for Universities to Produce Graduates in the Fields of Science & Technology;
  : Research Centers;
  : Associations;
  : Provincial Government (through funding for S&T data bases, improved taxation, establishment of incubators and procurement for its locally produced products.

- At the Community Level

  : People (Workers);
  : Improve networking;
  : Other Industries; and
  : Financing.

4. The Characteristics of Winnipeg

- We have enough industry to form critical mass
- We enjoy a varied industry on which to build our strengths
- We have the major portion of Manitoba's population, thus closer ties to Provincial Government than most other urban centers
- Unfortunately we also have substantial competition, rather than cooperation, amongst groups trying to advance community related projects
- We need to reverse our reputation for harsh and inhospitable climate
- Good universities and colleges
- National Research Facilities (recent)

  : Canadian Institute of Industrial Technology
  : Center for Sustainable Development

III RESOLUTIONS FROM PANEL DISCUSSIONS

This section presents the summary of the discussion and recommendations of the five panels organized. The panel leaders were provided with guidelines to ensure that an homogeneous process was followed. No attempt was made to substantially edit or re-format the results of the panels, to ensure that the integrity of thought of the participants would remain. The following are the objectives assigned for each panel. Appendix A includes the background information provided to the participants to focus the discussion.

Panel 1: What makes a Community Technologically Dynamic? The Growth Pole Debate. This panel addressed the question of why some communities are technologically creative. What are the characteristics of technologically dynamic community environments? What are the "hard" and "soft" infrastructure requirements? How are changes in the international economic system affecting the role of cities as "technology engines"? Is the Silicon Valley model appropriate for Canada, given these changes and considering the particularities of the Canadian economic, social, and governmental system?

Panel 2: Broadening and Deepening the Community's Technology Base" Infrastructure for the Development and Diffusion of Technology. This panel assessed the Manitoba's infrastructure for growing technology-based firms and for accelerating the diffusion of technology within existing firms. What is the experience with incubators, science or technology parks, technology transfer devices, information services, risk capital, technology venturing, etc.?

Panel 3: Roles and Responsibilities for Gearing up the Technology Engine at the Community Level. This panel concerned with the question of responsibility for "gearing up" the technology engine at the community level. What is the present division of labour among levels of government with respect to promotion of science and technology? What can municipalities do? What are the problems of coordination and focus at a regional and national level?

Panel 4: Science and Technology in Community Economic Development Planning. How do communities go about selecting priorities and generating vision about their technological future? What are the procedures, characteristics, and results of community-level strategic planning exercises concerning technology?

Panel 5: Building Community Technology Networks. This panel looked at the development of the various kinds of formal networks that have emerged within and among communities in support of technology development. What do these networks do? To what extent can they help a community overcome weaknesses in infrastructure?

PANEL 1A: **What Makes a Community Technologically Dynamic? The Growth Pole Debate**

Chair: **Dr. Bert Friesen**
President
ABI Biotechnology

Recorder: **Emilee Pedruchny**
InfoTech

GENERAL DISCUSSION:

The following are individual comments made by the participants of the group. These individual comments do not necessarily represent the opinions of the entire group.

- We need an inventory or a database of skills with everyone on it, government, education, research institutions, associations, private industry, etc. Local expertise has to be assessed, recognized, and promoted.

- Cannot use the same advertising message to reach both the tourism and the industry market. Sometimes the message we think we are sending and the message that is being received is not the same.

- We need a vision! And we need champions to promote this vision.

- We need to promote Manitoba from all aspects and everyone is responsible for this promotion. We can no longer continue to promote our negative image (mosquitoes and snow).

- We already know all the problems - the time is now to begin implementing plans to remedy these problems.

- Access to capital is a problem for companies developing or acquiring new technology. Traditional financing will not finance these projects and seed or risk capital is not available.

- In Manitoba, if you are pro-business, than you must be anti-labor.

- There is a need for practical experience from people graduating from the universities and colleges.

- The silicon model will not work for Manitoba. Our environment here is different and so is the timing. We need to attract large scale companies in science and technology. The spin-off from these large companies will help to build the fertile environment needed to develop a growth pole.

- The University stimulates development. We need better mechanisms to have industry come to the university.

- The pole debate - is it descriptive or prescriptive? The key is the enthusiasm of the people and the champions.

- Lack of acceptance by the local market is very frustrating.

- The growth pole issue is scary as it results in only three places in Canada having technology expertise.

- Informal networks, while being very effective, can also be very selective. Often you can be excluded if you are a woman.

- Industry needs to work more cooperatively with the crowns. The crowns undertake research and development which should be commercialized.

- Access to capital is a problem. Nobody is willing to take risks.

- The media must be used to generate knowledge and excitement.

- The public sector employs and plays a large part in stimulating and financing the community.

- People are the key! We lack self confidence and as a result we do not grow local heroes.

- Much of the industry is too regulated. This is very frustrating as we have to wait for government to make changes.

- Engineers should be given more business experience in their academic training.

- We need better incentive programs to encourage companies to set up and move here. We must advertise ourselves better.

- Manitoba has a lot of cultural issues.

- Networking is very important. Use your contacts, they can put you in touch with the right people.

- Small businesses are so busy that it is hard to find time to contact the university or government. As well, it is very frustrating trying to find the right person.

- Silicon valley is not all that great. Quality of life is very poor and quality of life is very important.

- All of our best human resources are leaving. We must create incentives to keep our people. People are the key!

SYNTHESIS & ACTIONS:

In order to define a fertile environment, the group felt it was necessary to outline some of the current constraints of the community and identify impediments to attract and conduct business within Manitoba.

Consensus: **The "growth pole" is a spin-off of a fertile environment.**

Issues:

Financing: Access to traditional and risk capital is difficult for Manitoba companies developing high technology or companies acquiring "unproven" technology.

Univ./Ind. Relations: Greater access to technology, technology transfer and skilled human resources would be available if strengthened education/industry relations were developed.

Human Resources: We are exporting a significant amount of our top human resources. Greater opportunity and a perceived better life-style are necessary to retain skilled workers.

Attitude: Difficult to promote Manitoba as a quality business and social community.

Networking: It can be difficult to develop the personal contacts necessary to conduct business. Many heads of companies and government are based outside of Manitoba.

Tax Policy: Require a restructured tax policy that would attract new businesses to Manitoba, provide an incentive for employees to remain in Manitoba and provide financing for the development and implementation of high technology.

Marketing: Lack of acceptance in the local market for new technology products is frustrating.

Building a Fertile Environment:

Dialogue: Need to create a dialogue between federal, provincial, & municipal governments, private sector, education community and industry associations to facilitate interaction on issues related to the science and technology sector.

Attitude: Undertake a public relations campaign to promote Manitoba. Outline the benefits of the province to those already in the province and those that could possibly locate here. Use of champions to promote the business and social values of the province.

Human Resources: Develop a strategy that will keep our valuable human resources in the province and make it attractive enough to entice people from other areas to locate here. Improve the labour relations environment. Promote a plan to encourage cooperative training, retraining and apprenticeships.

Technology Transfer: Encourage industry, government and education to work more cooperatively on research and development. Allow industry to have better access to the research and development within government, crown corporations and universities.

Research, Development & Innovation: Provide better incentives for industry to undertake research and development. Encourage companies to become globally competitive through the acquisition of innovative technology. Develop a tax policy that supports and encourages the financing of research, development and innovation.

Industry Assessment: The science and technology sector must be assessed. An inventory of our strengths and weaknesses is required. Our strategy should build upon our strengths and expertise. It is important to identify the components needed to develop a critical mass.

RECOMMENDATION(S):

1) *The immediate formation of a Premier's Council comprised of federal, provincial, municipal governments, the education community, private industry and industry associations.*

   The Council would consist of both a steering committee and a working committee. The council would be a source of guidance and would conduct a survey to determine issues of immediate need.

PANEL 1B: **What Makes a Community Technologically Dynamic? The Growth Pole Debate**

Chair: **Mr. Ralph Bullock**
Vice President, Engineering
Bristol Aerospace Limited

Recorder: **Craig Fossay**
InfoTech

GENERAL DISCUSSION:

The session was opened outlining six concepts to generate ideas and foster discussion amongst the group.

- Describe the process to improve communications and coordination mechanisms.
- Create a Premier's council at the provincial level to integrate the impact of technology to the various levels.
- Provide mechanisms for tax incentives at the community and provincial level. (e.g. Quebec)
- Highlight the importance of Winnipeg/Manitoba as a centre for communication and transportation.
- Develop federal research laboratories.
- Exploit universities to promote development of industry in the region.

The following are the individual opinions expressed by the panelists in answer to the Chair's invitation for opening remarks:

- We do not have a good enough understanding of the capabilities technologically which are right here in Manitoba. Perhaps an inventory, which would serve to show what is in Manitoba now and act as a benchmark in future to measure our progress in expanding this sector, should be assembled.
- Community communications could be improved. There is a need for a forum in which innovators could communicate. The MRC should facilitate and communicate Manitoba research capabilities. Some progress has been made in developing linkages between industry and academia, however, problems persist.
- The MRC should facilitate and communicate Manitoba research capabilities. Some progress has been made in the area of developing linkages, however problems exist in terms of communicating across industry and academia.

- In terms of the level of technological activity in Winnipeg - we need to become more positive about ourselves. The Province has a good diversified economy from which to build but we need to recognize that we are in a global economy. This necessitates operating outside of the country as a group.

- Models for development should be examined. For example, corporate support of universities and the producer-user relationship.

- We need to have education for the consumption of products. In the past decade, the number of computers has soared in the school system. In fact, every teacher is doing computer awareness programs. Despite this emphasis however, we are behind. The reason for this is the lack of communication between the corporate sector and educators. InfoTech is the educational "lighthouse" for the teaching community.

- One of the barriers in the educational community for technology diffusion is the difficulty which is encountered in funding capital purchases. We have not put a provincial pool of dollars together to leverage the federal monies. There is a distinct lack of coordination in this area.

- The implementation of effective management systems can sometimes reap more benefits than technology like CAD/CAM.

- There is a need to hire people with specialized expertise in order to remain competitive. These specialized skills are hard to find in Canada. As a consequence, they have had to hire people from other countries. This emphasizes the need for a forum in which to exchange ideas.

- Recognition for the value of technology development is not sufficient. Take the Voyager Spacecraft as an example. There is a need for education in managing technology. The business school should have a program for managing technology. The government should get away from incentives for the resource sector such as flow through shares. A network of mentors would be very valuable for the entrepreneur in this sector.

- We need leaders with wisdom. For example, review the growth of Minneapolis over the past 20 years. They are geographically isolated and have a cold climate. These barriers however have been overcome.

- Our major problem has been in obtaining trades-people who know what is going on in the area of expert systems in a factory setting. We have people who are 55 to 60 years of age who are not familiar with technology. Maintaining their employment can become a challenge from both an emotional and community standpoint.

- A major example of the benefits of networking is CIPS. There are greater than 5,000 people involved in information processing in Manitoba. CIPS is an excellent forum to exchange ideas. The academic community is not attending CIPS. They are working in isolation from industry. The University has a mind-set that although there may be an injection of monies, they wish to maintain ownership and market the products. Waterloo as an example has a great research department, but is not willing to take the risk of being an entrepreneur. Business and university need to communicate. The British model shows that government incentives and programs can actually become a dis-incentive.

- Take a look at the amount of training provided to employees in Japan. A Japanese employee receives 8 hours per week. Four of these hours are on company time and four on their own time. There is a new organization at the University of Manitoba called the Institute for Technological Development which has been set up to deal with the need for a common ground for dialogue between industry and academics. This should help each party understand the other's needs.

- Universities have a distinct culture. Professors are individuals. There is a serious problem in terms of ownership of intellectual property. Professors care most about getting work done which can be published. Professors do not have sufficient incentives to do work of a developmental nature which will not be published. The reason for this is that promotion as a professor is tied to publication of their work.

- Continuing education is an important source of training employees.

- A public awareness campaign promoting the "crisis in technology development" should be looked at. This could take the format of a "David Suzuki show". Marketing and R&D support are also needed from government. In achieving objectives a grassroots approach is necessary. Government should support organizations in development, but not interfere.

- We have worked with the University for 5 years and have had an excellent experience.

- In looking at the provision of monies to the University for research, we have adopted a businesslike approach to looking at what kind of return it would provide. There is the need to be competitive worldwide. In doing so, we need to work together to "search and steal". An area that needs to be looked at is the development of an educational system that focuses right down on the shop floor.

SYNTHESIS & ACTIONS:

Mr. Bullock summarized the discussion into the following key points requiring action:

1. Coordination
2. Networking/Communication
3. Education
4. Inventory
5. Image
6. Tax Policy/Financing
7. Management Training
8. Government Assistance

1. Coordination

- A focal point for a body to offer advice to government is required. This could take the form of a Premier's council.
- Pre-planning projects and strategic plans which involve the community would be effective.
- The media should be exploited for positive publicity.

2. Networking/Communications

- Associations should receive wider participation.
- Innovation and entrepreneurship should be promoted. This could take the format of an innovation week or meeting with booths. Seekers and providers of innovations could network at such an event.

3. Education

- Skills in the trades using apprenticeship programs need to be developed.
- Management training could take the form of a school of management for technology.
- Continuing education could be strengthened at the university level by networking with other universities.
- University-industry interaction needs improvement.

4. Inventory

- An inventory of Manitoba's technological capabilities needs to be assembled. This could be used for promotion purposes, as well as acting as a base line for comparison with other regions and future progress.

5. Image

- We need to have the provincial government do an inventory and then brag about Manitoba's capabilities.
- We should attract high profile conferences and symposia.
- We need to keep the media informed about our successes.
- We need to develop videos about our successes and technological capabilities.

6. Tax Policy/Financing

- Provincial R&D support is required.
- Equivalent treatment for high technology companies should be provided for in the national tax policy (re:advantages provided to the resource industry)
- Start-up capital expertise is required in Winnipeg. This expertise is currently found in Vancouver. The Winnipeg Business Development Corporation should work with the Winnipeg Stock Exchange in getting this moving.

7. Government Role

- Provincial government is now providing start-up capital. This is an excellent program.
- Federal government should renew the start-up incentives for immigrants.
- Zoning and tax incentives at the community level should be looked at by the Winnipeg Business Development Corporation.

8. National Labs

- Promotion of the activities and image of these centres should receive support from all levels of government.

A discussion was also held regarding the relative merits and demerits of doing business in Winnipeg.

Advantages:

- Costs are lower.
- University
- Government Research Labs
- Quality of life is key.

Disadvantages:

- Trained tradespeople
- poor self-image has led to an inferiority complex
- salary budgets to attract quality professors
- Financing
- Collaboration
- Tax Policy
- Lack of Government Consistency

RECOMMENDATION(S):

1) *Provide coordination to policy makers, through participative planning, community strategic planning, project pre-planning, creation of a Premier's Technology Council & public awareness through media.*

2) *Stimulate communications and networking through associations and to promote networking of entrepreneurs through regular symposia.*

3) *Focus education to meet community needs through: utilization of apprenticeships, management training in technology, continuing education, networking with other universities and university industry interaction.*

4) *Examine tax policy & financing to provide provincial R&D support, equivalent tax treatment and to attract start-up capital expertise.*

5) *Assemble an inventory of capabilities for use in the promotion of Manitoba and develop a baseline for future comparisons.*

6) *Enhance the image of the Province by attracting symposia, informing media, using the inventory of capabilities and developing videos.*

7) *Have the Government provide start-up capital, review start-up programs for immigrants, review the federal R&D tax credits and provide local zoning and tax incentives.*

PANEL 2A: **Broadening and Deepening the Community's Technology Base: Infrastructure for the Development and Diffusion of Technology**

Chair: **Mr. Barrie McPhalen**
Vice President & General Manager
Inland Cement

Recorder: **Karl Fabian**
W.B.D.C.

SYNTHESIS & ACTIONS:

It was agreed by the panel members that Winnipeg would be the target area for this discussion.

The identification and review of all known existing technology resources proved to be very informative. Based on the list developed, it was agreed that Winnipeg has, at its disposal, an abundant number of organizations quite capable of meeting the needs of our business community. The list included the following:

- Canadian Institute of Industrial Technology;
- Infotech Centre;
- University of Manitoba;
- Red River Community College;
- Atomic Energy of Canada Limited;
- National Research Council;
- Industrial Research Assistance Program;
- Manitoba Research Council;
- Industrial Technology Centre;
- Canadian Food Product Development Centre;
- Industrial Science and Technology Canada;
- Industry, Trade and Tourism; and
- The Winnipeg Business Development Corporation.

These organizations need to be made more aware of industries needs and must make a stronger conscious effort to meet the changing demands of industry. Likewise, industry must assume the role of educating themselves on what resources are available that can be called upon to improve their ability to compete in the growing and ever changing marketplace. It is clearly evident that the infrastructure exists but requires coordination into a master plan.

It was agreed that an organization is required to facilitate the identification and accessibility of technology in Winnipeg. The Winnipeg Business Development Corporation is presently too broad based, but could be expanded to fulfill this role by creating within it a specialized group to deal with technology opportunities

In examining the challenge given, this panel determined that no organization was in place to define the status of Manitoba industry and to determine the vision of the future for industry. The establishment of a Premier's Council made up of very senior business and community leaders would do such a survey, and then make specific recommendations to insure that an action plan for the future was developed. This Council would be a source of guidance and enthusiasm for industry and would be available to provide advice on issues of immediate need.

Recent statistics and reports providing a view of the global marketplace tell us that we are in a critical situation in declining technological growth and must respond now. The Winnipeg business community at the management level appears too complacent with respect to acquiring new technology. Becoming more competitive with increased quantity and improved quality is desirable, but when it involves acquiring new technology and equipment it is often perceived as an "unnecessary expense". It is here that government should provide the support necessary to revise the planning process of our industry leaders. Technological growth must become a priority in the Operating Plan. We can no longer wait to become a global competitor.

Although there are a number of agencies available offering funding, they are few in number and difficult to access. Unless the application is tailored specifically to comply with the program prerequisites it will often be subjected to a series of delays and oftentimes suffer rejection.

RECOMMENDATION(S):

1) *The establishment of a Premier's Council made up of very senior business and community leaders would do such a survey, to then make specific recommendations and ensure that an action plan for the future is developed.*

2) *That the City of Winnipeg ensure that W.B.D.C. continues to function and be expanded and adequately funded to successfully assume this role.*

3) *That an amending formula be considered by all funding agencies and that proper procedures be applied to simplify the red tape and become more user friendly. They should review and select each applicant based solely on their own merit.*

4) *That the Provincial Government accelerate the procedure of encouraging and establishing funding concepts that would be able to assist the needs of technological growth industries. Some form of incentives should be offered to stimulate private investment groups to become more actively involved. Offshore investment could also be encouraged to provide the much needed funding for R&D activities. A clear and definitive strategy should be developed by both the Federal and Provincial Governments, specifically addressing these issues within the time frame of one year, followed by the implementation of specific programs designed to target technological growth. It is this kind of visionary leadership we look for from Government.*

PANEL 2B: **Broadening and Deepening the Community's Technology Base: Infrastructure for the Development and Diffusion of Technology**

Chair: **Mr. Ed Prefontaine**
President
Rescom Ventures

Recorder: **Terry Patton**
W.B.D.C.

GENERAL DISCUSSION:

- Target of discussions is to broaden and diffuse Technology base thereby encouraging growth.

- Emphasis should be toward growth industry sectors endemic to Manitoba i.e. natural resources, aerospace, health, environment, manufacturing, etc.

- Must promote awareness to the discovery of Technology i.e. R&D availability; as well as the application of Technology, i.e. market acceptance.

- There must be open collaboration and communication cataloguing all research facilities and capabilities.

- The "who cares" attitude toward technology, particularly in management, needs to change. There is generally a weak knowledge base, not only in Manitoba, but nationally. The focus will have to be on winning ideas and winning companies, with them acting as role models.

- There is a lack of risk, equity and venture investment. The marketing infrastructure is a lengthy process creating investment delay.

- Financial organizations lack champions who have knowledge in the effective application of technology. The Venture Capital resource base lacks recognition, awareness and the assessment capabilities of funding high risk opportunities.

- Because R & D and Technological advances are costly, there is a definite lethargy in management attitudes. Education facilities have fallen short in this area.

- Historically, Universities have been provided little funding credit for R & D facilities. Manitoba Universities need funding and reorientation to support private sector R & D.

- Because of present day owner/operator general attitudes, it will require a 5 to 10 year period between the introduction of new technology to the successful fruition of its application.

- We are in a survival mode and desperately need to encourage an awareness of the advantages of technology to bring about a growth cycle.

- All levels of government should adopt a stronger role as facilitators rather than financiers in the advancement of technology. Technology provides solutions to economic deficiencies and government should devise techniques of drawing community leaders and champions together to share awareness of technological capabilities. Business drives technology.

- Governments should work toward filling the educational void by emphasizing the influence of Science & Technology on society through all means of public exposure.

- R & D and technology should be marketable entities and not limited to the end result of production.

- There should be stronger connections between the technology creator and the applicator i.e. closer ties between wealth (benefit) and the creator. Research facilities could benefit monetarily but, in any event, they require feedback from the end user.

SYNTHESIS & ACTIONS:

1. Awareness:

   - Difficulty in discovering availability of technology.

   - Companies need help in becoming aware of specific benefits by specific applications of technology.

   - Need for collaboration and communication of all R&D facilities in the community.

   - Awareness leads to encouragement, which leads to growth, which leads to attraction of technology-based firms.

   - Community leaders and champions should facilitate a Technology Committee to develop a strategy to increase awareness.

2. Attitudes:

- Aging small to medium business management and owners who do not think in long terms make it difficult tointroduce a change.

- We are in a survival mode and advanced technology focus will have to be emphasized to those with winning attitudes.

- Risk, equity, venture capitalists, generally have a weak knowledge of technological advances. Government funding can be a lengthy process.

3. Diffusion:

- Capture of technology seems to lack a priority thrust in the Community.

- R&D facilities in the community should not be limited to the focus or result of our own local production. Their capabilities should continue to be marketed globally.

- Governments can continue to play financier in hard R&D, but should play a larger role as a facilitator in the diffusion of technology.

- There is a need for closer connections between the creator and applicator. Feedback is a necessity.

4. Finances:

- Risk, equity, venture capital resource base is not inclined to recognize and fund high risk opportunities.

- The application and commercialization of technology should be emphasized more strongly.

RECOMMENDATION(S):

1) That committees, comprised of members of the community and facilitated by government, be formed within the next four months to discuss the major topics and develop a plan of action, with final recommendations being available by year-end. Such committees should address the following:

a) *Need for Community Awareness*

- *education awareness (schools, programs)*
- *corporate awareness (uses)*
- *implementation awareness (developers)*
- *financing awareness*
- *general awareness (media) reaching the voter and ultimately the political decision makers*

b) *Need for Community Financing*

- *examination of financing resources*
- *initial R & D*
- *new starts*
- *expansion of existing companies*

c) *Need for Feedback from the Community - "Business Drives Technology"*

- *identification of business needs*
- *co-operative projects, joint ventures*
- *purchases*
- *determination of key sectors*

d) *Focus/Emphasis on Winning Ideas and Winning Companies*

- *assessment process*
- *consulting services*
- *promotion process*
- *government as facilitator and support*
- *government policy - scarce resources*

e) *Focusing the Effort*

- *basic R & D (government)*
- *implementation of R & D (private sector)*
- *both (integration)*
- *common approach*

PANEL 3: **Broadening and Deepening the Community's Technology Base: Infrastructure for the Development and Diffusion of Technology**

Chair: **Professor Marion Vaisey-Genser**
Associate Vice-President - Research
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Recorder: **Mel Cornell**
IT&T Technology Division

GENERAL DISCUSSION:

The major goal of improving the quality of life through improving our global competitiveness was examined through a brief assessment of factors that influence the climate for effectively motivating the engine of economy. In order to achieve and maintain our Quality of Life we need the capability to generate wealth.

Manitoba is looking perilous from the aspect of the current state of the manufacturing sector. Several key factors need to be addressed to improve the business climate.

- The impact of provincial sales taxes on R & D activities as well as on product is seen as a disadvantage in the free trade environment;

- The difficulty in not having enough readily accessible financial support is responsible for inventors seeking U.S. funds at the risk of losing the technology to the Country;

- Venture capital is overly regulated by the Bank of Canada and over-regulation is keeping long distance tele-communication rates artificially inflated;

- There is a sense of urgency implied in the recognition of a limited time horizon within which remedial actions need to take effect;

- The public has to be convinced that our industrial stability is eroding.

Part of the solution requires focusing on local strengths that need to be built on, looking at technologies and processes that make sense for Manitoba, and determining the niche areas that offer the greatest opportunities for long term economic gain. The Health Care initiative is an example.

On a more positive note, Manitobans work-attitude is perceived as good. The infrastructure is in place but there needs to be a much greater attempt at strengthening the linkages between Universities and Industry. Transportation avenues provide good market access across the country through a full range of carriers.

The business community needs to create opportunities to employ and challenge our graduates. Manitoba is noted for producing good graduate students, who are rapidly becoming our "best export". The short-term future over the next 5 to 6 years carries a need for engineers with skills in the management of technology. The consensus was that there needs to be a re-examination of the "philosophy of teaching" to change the perception of the student body to view business and entrepreneurship as positive factors.

There needs to be an attitudinal change brought about to influence the minds of young people to become more business career oriented. Collectively we need to get out of the custodial-trusteeship mode and get into an entrepreneurial mode. Industry also needs to make better use of existing institutions.

SYNTHESIS & ACTIONS:

The panel members agreed that the discussions initiated through the Round Table process need continuity and dynamism. There has to be a mechanism to allow private sector voices to dialogue with elected officials primarily at the provincial level, but also with municipal and federal elected members.

There needs to be a structure that allows liaison with bodies that have potential to influence economic development. The federal system has a National Advisory Board on Science & Technology. Manitoba needs an Advisory Board on Science and Technology to advise the Premier.

To bolster Manitoba's weakened innovative capacity at a time when increasing international competition and non stop technical change demand the highest level of innovative capability will require bold action on the part of many players. This can be achieved by establishing a Premiers' Advisory Board, chaired by the Premier with membership from the private sector representing both high and lower technology interests. The high profile group of leaders would function as an organized body, totally apolitical, and work in a highly confidential mode, as key partners in Manitoba's development.

The terms of reference would be developed after the Board membership was selected. Secretariat services would be provided by the Department of Industry, Trade and Tourism, with appropriate staff secondments to augment the group and special skill consulting work contracted as required. The Panel felt immediate attention could be directed toward the following:

1. An identification of strengths and weaknesses to shift the focus towards industrially relevant areas.

2. The need to recognize wealth generating capabilities of the emerging knowledge-based industries as well as the service sector.

3. The need to increase cooperative research among industries and between industry and university.

4. The identification and focus of effort and R & D resources on strategic priority sectors.

5. The revamping of teaching philosophies to capture the promotion of education for entrepreneurial activities, with a curriculum to attain these goals.

6. The need to improve areas of taxation and fiscal measures which influence innovative activities.

RECOMMENDATION(S):

An action plan agreed to by the Panel was presented at the plenary session, outlining the following recommendations:

1) *Recognize the need for a Manitoba Board on Science and Technology. The main recommendation for a Premier's Advisory Board, to be set up with selected representation predominantly from private sector interests and chaired by the Premier, was viewed as a critical first-step towards economic stimulation:*

   - *To be chaired by the Premier;*
   - *To advise and dialogue with Premier and Mayors and Reeves and Federal Members on a confidential basis;*
   - *To liaison with Chambers of Commerce and other organizations charged with influencing economic development;*
   - *To have representation by 10 selected members drawn from a cross section from high and low technology areas, from private sector and academia;*
   - *To establish a Secretariat services to be provided by Province with appropriate secondments,*

2) *Recommendations to be carried to the appropriate political leaders by Roundtable Chairman Ed Martens and Panel Chairs;*

3) *The Group to reconvene within six months to review progress.*

PANEL 4: **Science and Technology in Community Economic Development Planning**

Chair: **Mr. Michael Hill**
Senior Consultant
Peat Marwick

Recorder: **Rod Sprange**
InfoTech

GENERAL DISCUSSION:

In order to focus discussion the group needed to define science and technology; the panel agreed to adopt the definitions found in "Science and Technology in Canada (Manitoba Edition)". However, it was agreed that technology should also encompass knowledge industry technologies, eg. the technology of process as applied to planning. It was agreed that the business of consulting was a wealth generator and technology consulting was to be included the discussion. The following are individual views that were expressed during the open discussion and are not necessarily the views of the panel.

- When considering technology applications the question must be asked " where do people go to find out about technology?"
- A lot of economic planning tends to be based on government largess rather than on local strengths.
- Planning needs to consider both the strengths of local technological capability and the degree of local consumption.
- What can be done to help the smaller Manitoba manufacturer to utilize technology which will make them more competitive.
- Are existing support structures such as the Manitoba research Council effective; are they utilized as much as they should be?
- This panel needs to better understand the economic planning process at the community level, in order to comment effectively.
- There was a feeling in the panel that community level economic planning was abysmal, usually taking the approach of "chasing the carrot"
- We should be focussing our discussion on the specific problems of Winnipeg, i.e Winnipeg has a lot of family owned businesses with regional markets, but outside competition is starting to impact these businesses.
- We should also consider the more generic problems faced by smaller communities in economic planning.

The Planning Process:

- Hi-tech companies and hi-tech government doesn't necessarily give us the tools we need for planning for hi-tech development. Usually the problems in planning centre on the lack of suitable process.

- It is not true that uneducated people give good advice!

- The lack of a formal approach to planning at the community level is a fundamental problem.

- Before we can plan, we need a vision of what Winnipeg should and can be. Who does that? Various leaders in the community?

- The process should be to identify the vision and objectives and then develop a strategic plan to achieve this vision.

- Perhaps you get 8 or 10 larger private sector enterprises who develop a vision and obtain support from the community.

- There are two approaches we could use, 1. A visionary or group of visionaries develop a vision and champion the vision or 2. The grass roots approach which looks at community strengths.

- The first thing is, How should Winnipeg select a vision, what approach is most appropriate for this community?

- What is Vision? Goals/Dream?

- Martin Luther King had a vision - " I have a dream"

- We need to establish an environment that allows an individual with a dream to be nurtured and which allows that individual to run with their dream.

- You don't replace "Joe Hussle".

- We need one or two leaders with the vision and desire to get it achieved.

- The Winnipeg environment doesn't provide an easy route for small companies with a good idea to get things going.

- It is very hard to get into science or technology businesses, they are costly and difficult.

- We need an environment which allows the visionaries to succeed.

- We should create an environment in which entrepreneurs will feel Winnipeg represents a good opportunity to succeed.

- The organizations currently doing the planning don't have the expertise to do the right type of planning.

- Should we select role models of entrepreneurs and interview them to understand what would attract people like them to a community like ours?

- We may need to attract a high level "macro" visionary, or bring one in.

- The things that have started and prospered in Manitoba have been the result of individual initiative. Some have been related to natural strengths we have, eg. Hydro/Teshmont There are some unrelated to strengths, eg. Bristol Aerospace, Selkirk Rolling Mills. Government role should be to create the (right) environment in these areas: Taxation; General technology services (MRC etc); Venture Capital; Strengthen the strong; Provide a better resource inventory of what we have (technical and human).

- There is an opportunity to develop the electro-chemical technology industry.

- In a global marketplace, it is much harder for companies to be able to see what is available in terms of marketing their product. We need to look outward as well as inward.

- We need to look at the educational community to ensure that the human resources are available in Winnipeg.

- An educated workforce is needed, I havn't seen much support from the private sector.

- Why not look at other countries that are growing to see what they are doing in terms of education and the roles of industry and government?

- There is a complete lack of Macro level planning, we need to treat technology development as important as defense.

- Maybe we should be far less targeted in funding R & D we tend to put money into specific rather than general development.

- How do we encourage things like the 3M executives who worked with the University of Minnesota, and developed the skin patch technique.

- We should encourage more exchange programs between educational and business institutions.

- We need to be creating more partnerships, identify large consuming organizations and match them with potential suppliers.

- Business is afraid of government and does not want government planning.

- I don't want us to recommend that we hire a guru and staff and just create another bureaucracy, you can't create something that doesn't belong.

- If there are no jobs in a particular community people should move.

- The biggest opportunity is to increase productivity through the use of technology.

- There is a need for greater communications and interviews to make it clear what the environment should be (in Winnipeg) and to make better use of the existing facilities in the Province.

- It is very hard in Manitoba to find industry partners to run with.

- Most Canadian students are not entrepreneurial, how do we make fundamental changes to the way that Canadians think about their lives and careers.

- We should look at some kind of campaign for technology, look how successful PARTICIPACTION has been.

- We should get on and do something, rather than attempt to come up with the perfect plan.

SYNTHESIS & ACTIONS

In summary there was agreement that the creation of an appropriate enabling environment should be the goal for Winnipeg. Once this environment is in place then entrepreneurs will create the visions and establish the necessary actions for their achievement. The panel therefore agreed to the following points of discussion:

- identify some of the components of the "right" environment;
- Develop an action plan that would lead to the proper identification and detailed description of what that environment should be;
- Develop an action plan which would establish the most appropriate process for achieving the right environment; and
- Identify who should be responsible for getting the activity underway.

1. The Right Environment.

    - Stimulate an educational environment that champions technology;

- The environment should be competitive in terms of attracting, developing and retaining key individuals;
- The environment should provide key resources; and
- It should include resources capable of providing worldwide marketing intelligence.

2. Action plan for the identification of the right environment.

- Study our own environment;
- Establish a group to hold hearings re. what is conducive to science and technology development and adoption (what needs to be improved);
- Discover and review models that have been successful;
- Interview the kinds of key individuals elsewhere that represent the types of individuals we need to attract and nurture in this community for their views on what would be an attractive environment;
- Review all ideas critically; and
- Keep the group at arms length from specific organizations (Government etc.).

3. Establishing the process to achieve the right environment

- Ensure there is (are) a Champion(s);
- Set up an education process to bring communities up to the level of being capable of doing effective strategic planning;
- Introduce more entrepreneurship into the schools;
- Inculcate entrepreneurial spirit and create some science and technology heroes;
- Work at macro planning level (set up a process that facilitates micro level planning); and
- Improve economic planning skills at community level.

4. Who should lead the action?

- Organized and initiated through the Chamber of Commerce;
- Coordinated by a consortium of private sector organizations;
- Champions lead the actions e.g. CMA, CTA, WBDC;
- Volunteer participation; and
- Obtain local mandate within six months (including government endorsement).

RECOMMENDATION(S):

There is a need to develop a "right enabling environment" as a goal for Winnipeg. The Chamber of Commerce should lead the formation of a consortium of private sector organizations to coordinate community champions to lead the action through volunteer participation and secure a local mandate within the next six months.

PANEL 5: **Building Community, Regional and National Technology Networks**

Chair: **Mr. James Wright**
President and General Manager
Dimatec Inc.

Recorder: **Bill McGregor**
NRC/CIIT

GENERAL DISCUSSION:

The session began with a brief outline of the questions to be addressed and the goal options. These goals were:

- Attract "high-tech" firms (the Silicon Valley option);
- Encourage indigenous firms to use technology;
- Create a "lightning rod" to attract opportunities looking for a home. Make sure we are not "passed by"; and
- Utilize existing community resources better.

The group had no clear preference. In consensus, we need a balance. We must attract and secure some of the "shiny new" high tech industries but also need conventional industry's technical growth to enable its competition in the world.

The group agreed emphatically with the need to encourage the wealth creation sector of the economy in order to sustain the quality of life and infrastructure sectors. Further, this priority is not well understood in the community.

Attitudes must be changed in this regard within the business community as well as in the other sectors of the economy. A myth must be dispelled that education is "for the young". Adult retraining is becoming more and more critical and will be a big "growth industry".

Early in the session, it was pointed out that we were talking about the region, not just Winnipeg. There are many networks across the province in various communities. A basic problem is that these networks do not communicate. For example, industry must interact with education.

The individual community is in the best position to determine what its "place in the sun" should be. What it needs is information in order to make that choice. This could be provided by better network interaction. The communities must become knowledgeable in "what technology can do for them" and "come to understand the role and character of wealth generation".

SYNTHESIS & ACTIONS:

Considerable discussion centered on what many in the group believe to be our area's greatest under-utilized asset; "the quality of life". This observation came from the new Manitobans in the group. It was also noted that we should get away from pitting "city against city". Look at the region, for example call it a high tech heartland, and actively promote with passion.

Considering the many networks within the region's communities, there are wasted resources. We must make more effective use of our volunteers. We have too many agencies. How do we rationalize?

RECOMMENDATION(S):

1) *Some group, perhaps the WBDC, should develop a province-wide listing of all associations and network contacts together with the organizations' "mission". This list could be made available to others as well as analyzed for "community of interest" between organizations.*

2) *Opinions were divided on whether a Premier's round table, including all sectors, or a private sector initiative should hammer out agreement on what needs to be done, regarding co-ordination and to provide direction. Some senior group needs to initiate. It will not happen by itself.*

IV MODERATOR'S SUMMATION

Chair: **Dr. Arnold Naimark**
President
University of Manitoba

The presentation of the workshop summaries by the seven panel leaders indicated a broad consensus on four major areas for action:

1) The establishment of a Premier's Council to facilitate the process of identification of opportunities and coordination of actions throughout the community;

2) Formalization of mechanisms to achieve coordination in economic development planning amongst the leaders business, academia and government;

3) The establishment of an inventory of strengths and resources available within the private sector, university and governments and complementary mechanisms to identify problems and opportunities in economic development; and

4) Exploitation of opportunities for government enterprises to interact with the business community and universities in the promotion of technology development and transfer.

In summary, there was agreement that follow-up to the conference is essential to keep the spirit and commitment of the community to cooperative action alive. Organizers of the workshop should formulate an action plan to present to government, business and educational communities, which reflects the outcome of the workshop so that new initiatives can be identified and supported through a high level commitment.

CLOSING REMARKS

Chair: **Mr. Ed Martens**
Chairman
Winnipeg Business Development Corporation

At the conclusion of the day, The Chairman of the Manitoba Workshop indicated that the Steering Committee will act as an interim group to bring forward the recommendations to key government and business leaders. Following these discussions the Manitoba community will be informed about such progress.

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Dean of Engineering
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R3T 2N2
474-9807
Panel 3

Panelists continued.....

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Winnipeg Manitoba
R3T 2N2
474-9842
Panel 2A

Mr. Gary Leach
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P.O. Box 2500
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R1A 2B4
284-5395
Panel 4

Mr. Allan Lee
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CAD Systems Inc.,
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R3B 1Y6
943-6673
Panel 2B

Mr. Ron Leslie
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523 - 167 Lombard Avenue
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R3B 0V3
947-9221
Panel 5

Dr. Peter Letkeman
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R7A 6A9
727-9625
Panel 2B

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R2C 1A8
224-1616
Panel 2A

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R3C 3Y9
983-2630
Panel 4

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R3B 1Y6
983-7692
Panel 5 Recorder

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R3T 2N2
474-9874
Panel 1A

Mr. Don McLean
Manager Business Development
Atomic Energy of Canada Limited
Whiteshell Nuclear Research Establishment
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ROE 1L0
753-2311
Panel 3

Mr. Barrie McPhalen
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P.O. Box 249, Station C, 1191 Kenaston
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R3M 3T2
474-1401
Panel 2A Chair

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R3H 0J9
632-2272
Panel 4

Panelists continued.....

Mr. Herb Middlestead
President
The Winnipeg Chamber of Commerce
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Winnipeg Manitoba
R3B 3E5
944-8484
Panel 5

Mr. Gerry Miller
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Computer Services
University of Manitoba
Winnipeg Manitoba
R3T 2N2
474-8230
Panel 2B

Mr. Arnold Naimark
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University of Manitoba
Room 200, Administration Building
Winnipeg Manitoba
R3T 2N2
474-9345

Mr. David Newman
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R3B 0V6
942-2561
Panel 5

Mr. Ray Newman
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R3H 0J9
632-2360
Panel 3

Ms. Myrtle Nichols
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632-2380
Panel 5

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R3C 3H8
945-8744
Panel 3

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R3B 1Y6
943-9012
Panel 2B

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R3B 0V3
944-8686
Panel 2B Recorder

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R7A 6N2
728-3287
Panel 5

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R3J 0Y9
945-8095
Panel 1A Recorder

Mr. Rod Pennycook
Executive Vice President, Corporate Resources
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R3C 3A5
946-7400
Panel 3

Panelists continued.....

Mr. Jack Peterson
President
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R3J 1H5
831-9550
Panel 1B

Mr. Fern Pitre
Mill Manager
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R0E 1M0
367-2203
Panel 5

Mr. Edward D. Prefontaine,
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Winnipeg Manitoba
R3G 0B3
783-4614
Panel 2B Chair

Mr. Carl Radimer
Vice President
Smith-Radimer Communications Inc.
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Winnipeg Manitoba
R3B 2J2
947-3403
Panel 1A

Mr. Brian Ransom
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R3M 3T1
474-3988
Panel 4

Dr. James Reichert
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945-2032
Panel 3

Mr. Leonard Rivard
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945-6934
Panel 5

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R3T 1Y4
453-6833
Panel 1B

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R3T 3J7
269-7264
Panel 1A

Mr. Harry Schulz
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St. Boniface Research Centre
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Winnipeg Manitoba
R2H 2A6
235-3206
Panel 4

Dr. Lorne Seier
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Vita Health Company (1985) Limited
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Winnipeg Manitoba
R2J 3M2
661-8386
Panel 1A

Dr. Morris Silver
Health Industry Tech. Transfer Office
Faculty of Medicine
University of Manitoba
Winnipeg Manitoba
R3E 0W3
788-6377
Panel 4

Panelists continued.....

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R1N 2Z4
857-4430
Panel 2A

Mr. Gordon Smith
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R3C 3Z3
949-1693
Panel 2A

Mr. Al Snyder
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R3M 3T1
474-3311
Panel 5

Mr. Rod Sprange
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R3J 0Y9
945-5268
Panel 4 Recorder

Mr. John Stapleton
Dean
Faculty of Education
University of Manitoba
Winnipeg Manitoba
R3T 2N2
474-9001
Panel 1B

Mr. Wayne Stewart
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Canadian Manufacturers Association
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633-4221
Panel 5

Mr. Don Taylor
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233-7133
Panel 1B

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R3B 1Y6
942-2992
Panel 1B

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R3H 0C7
783-2228
Panel 1A

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Manager, Business Development
A.E.C.L., Whiteshell
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R0E 1L0
753-2311
Panel 2B

Mr. Brian Trenholm
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R2H 2A6
237-2444
Panel 2A

Ms. Marion Vaisey-Genser
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R3T 2N2
474-9404
Panel 3 Chair

Panelists continued.....

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R3C 3V6
941-7651
Panel 4

Mr. Stanley L. Milson
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Quality Communication Products (1979) Ltd.
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R0G 1J0
822-4431
Panel 3

Mr. Jim Wright
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R3J 3W1
832-2828
Panel 5 Chair

Ms. Helen Wright
Senior Vice President, Operations
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R3A 1R9
787-2346
Panel 2B

Mr. Paul Zanetel
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